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ECONOMIC FEASIBILITY OF DLA
MATERIEL MAINTENANCE MISSION

DEPARTMENT OF DEFENSE

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LOGISTICS
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Operations Research and Economic Analysis Office

Cameron Station,
Alexandria, Virginia 22304-6100

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October 1988

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**Economic Feasibility of
DLA Materiel Maintenance Mission**

October 1988

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Mr. Thomas L. Brooks
Operations Research and Economic Analysis Office
Headquarters Defense Logistics Agency
Cameron Station, Alexandria, Virginia 22304-6100

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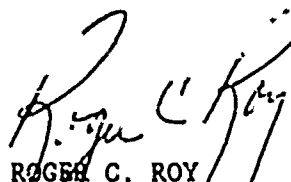
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FOREWORD

The Defense Logistics Agency (DLA) Directorate of Supply Operations requested from DLA's Operations Research and Economic Analysis Office (DLA-LO), a study to reevaluate and update a series of formulas presented in DLAM 4151.1, DLA Mission Materiel Maintenance Management Manual, for use in computing the economical basis for repair of unserviceable stock. It was determined that prior to this reevaluation, it would be appropriate to determine the economic feasibility (profitability) of DLA's materiel maintenance mission. This study examines the economic feasibility of stock maintenance operations.

DLA's maintenance operations appear to be economically sound. The yearly net economic value generated, compared with the value of the assets employed, represents a rate of return greater than 10%. We estimate that the total economic benefits generated during Fiscal Year 1987 were \$32 million, the total economic costs were \$26 million and the value of the assets employed was \$26 million. Because of the questionable validity of some of the data used for this analysis, we recommend that, before any decision is made which would make major changes to the size or scope of the operations, an additional analysis should be made using more reliable historical data.

Our primary recommendation is to modify the Job Order Tracking and Management System used by the stock maintenance operations to allow the generation of this valid historical cost data base. After this is accomplished, it will be possible to reevaluate and update the formulas presented in DLAM 4151.1.


ROGER C. ROY
Assistant Director
Policy and Plans

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Executive Summary

This study resulted from a request from the Defense Logistics Agency (DLA) Directorate of Supply Operations for a reevaluation and updating of the economic formulas used to select individual items for repair by the Stock Maintenance and Repair operations. It was determined that an analysis of the economic feasibility (profitability) of the entire maintenance operations would be appropriate before the formulas were reevaluated.

In an effort to determine economic feasibility, it was necessary to define and quantify the relevant economic costs incurred, the true economic benefits generated and the value of the assets used by the Stock Maintenance operations. The net economic value generated by the Stock Maintenance operations (benefits less costs) was then compared with the value of the assets to determine the rate of return represented by DLA's investment in Stock Maintenance assets.

Requests for historical data for the third and fourth quarters of Fiscal Year (FY) 1986, and the first and second quarters of FY 87, were sent to DLA's Depots in Ogden, Utah and Richmond, Virginia. In some cases, the data was reported for the periods requested and in others, the data was only available in aggregate for FY 87. Some of the data was not available at all. Because assumptions had to be made to match the data reported over the mixed time periods and because unavailable data had to be estimated, the information in this study can only be used to evaluate the maintenance operations in a general manner.

We feel that DLA's Stock Maintenance operations are economically feasible. As 10% is the Department of Defense proxy for the opportunity cost of public funds (this is used for determining net present value in DLA's Economic Analyses), and the rate of return generated by the Stock Maintenance operations exceeds 10%, we conclude that the Stock Maintenance operations represent an economically practicable investment of DLA's funds.

The primary recommendation from this study is to add to and modify the information provided by the current Job Order Tracking and Management System. Some of these changes involve the calculation of "savings," the addition of certain material costs, and the inclusion of depreciation. After this is accomplished, it will be possible to update the economic formulas, identify the classes of repair that fail to generate a suitable return, weigh policy issues regarding reimbursement rates, and evaluate other methods for overhead allocation, etc.

We do not recommend changing the reimbursement policies used to determine the flow of funds from the Supply Centers to the Depots for repair work performed. However, we do suggest that a proper evaluation of the economics of the Stock Maintenance operations requires more than just an analysis of the cash flows between the Centers and the Depots.

I. INTRODUCTION

A. Background

The Defense Logistics Agency (DLA) Directorate of Supply Operations requested DLA's Operations Research and Economic Analysis Office (DLA-LO) to determine the economic feasibility of DLA's Stock Maintenance and Repair operations and to define the real costs and benefits that result from the Stock Maintenance operations. For this analysis, economic feasibility is defined as that condition where net economic benefits are sufficient to justify continued existence of the operation. This is similar to profitability, in the private sector.

This analysis could then be used, in conjunction with a qualitative analysis of the compatibility of Maintenance operations with DLA's mission, to determine the proper size and scope of maintenance activities. In addition, the analytical framework used for this evaluation may be helpful in later analyses of methods for selecting individual items for repair.

B. Objectives. The objectives of this study were to determine total economic value generated by Stock Maintenance operations, to estimate the value of the assets used by these operations, and to evaluate the return on the investment represented by these assets.

C. Scope

This study considered only the primary Stock Maintenance activities, which are located at the Defense Depots in Richmond, Virginia (DDRV) and Ogden, Utah (DDOU), and primarily used historical data for Fiscal Year (FY) 87.

Originally, the study was to be a quarterly analysis of the Stock Maintenance operations using data for at least the third and fourth quarters of FY 86, and the first and second quarters of FY 87. Each of the five classes of Maintenance or Repair (new procurement repair, manufacture of items for clothing and textiles, repair of condition code F stock, routine maintenance and assembly type operations) was to be examined.

It was necessary to change the original scope of the project because of a lack of necessary data. The Stock Maintenance operations at each depot could only be considered in aggregate because little data was maintained in segregated form. Also, the operations could only be evaluated on an annual basis for FY 87, because in some cases, the data was only available in aggregate for FY 87.

II. METHODOLOGY

In addition to modifying the original scope of the study, it was necessary to change the approach of the study. Originally, the Stock Maintenance performance was to be evaluated through the collection, compilation and analysis of historical data. Instead, with the reporting of costs and benefits over mixed time periods and with much of the necessary data missing, it was necessary to make and validate many assumptions, any one of which could affect the results of the study.

There were several steps to this study. First, relevant types of costs and benefits were defined and then several ways of comparing the various costs and benefits were evaluated. Next, data necessary for evaluation of the Stock Maintenance Divisions was specified and sources identified. For missing data, necessary assumptions were made. Finally, the data was compiled and reorganized into a suitable format from which inferences could then be made.

A. Definition of Relevant Costs and Benefits. It is useful to note the differences in the way some terms are used in this study, and the way similar terms are currently used to describe Stock Maintenance costs and benefits. The definitions of some of the key terms are as follows:

1. Total Revenues. Total revenues are the products of the actual numbers of items repaired and their unit prices. This is similar to the Stock Maintenance Division's Job Order Tracking and Management System (JOTAMS) reporting of "total put back into storage."

2. Core Costs. These are the costs to get the items to the depot so they can be repaired. For returns of Condition Code F stock meeting certain inventory level criteria, the Item Manager may credit the accounts of the field activity returning the reparable items. These credits are intended to reimburse the field activity for the value of the reparable item. These credits plus the transportation costs are the core costs for repaired items. For assembly operations, core costs are the value of the Government Furnished Materials used.

3. Total Costs to Repair. These are all material costs, direct and indirect labor costs, overhead, clerical and administrative costs, etc., but most importantly, they include depreciation of equipment and buildings and all core costs. This is distinct from the JOTAMS "actual repair cost," which does not include these last two.

4. Net Income. This is the total revenues less the total costs to repair. This is quite different from the oft quoted, JOTAMS "total savings" which is the unit price of all items inducted into repair less the actual repair cost.

5. Variable Costs. These costs all vary with the work done by the Stock Maintenance Divisions. These costs include labor, materials and some overhead. The distinguishing feature or characteristic of this class of costs is that, in total, they vary directly with the Stock Maintenance workload.

6. Fixed Costs. These costs do not vary with the workload. These costs are the clerical and administrative support provided by the Depot or Center Staffs, the fixed asset charges (like rent or depreciation), and the utility, security and management costs, etc. These costs remain the same from period to period, regardless of the workload.

B. Methods of Comparing Costs and Benefits

1. Type of Analysis

In the analysis of Stock Maintenance operations, the relevance of certain costs and benefits can only be determined after it is decided whether the study is to be a cost-effectiveness analysis or a cost-benefit analysis. For a cost-effectiveness analysis to be appropriate, there must first be a presumption that there is some minimum level of service that must be provided. In general, activities that must provide a certain level of service are considered "mission-essential." For these activities, even if the economic benefits are less than the economic costs (resulting in a net economic loss), the operations must be continued. For an analysis of this type of activity, the goal is to determine the least cost method of providing the minimum required level of service. Economic feasibility should not be used.

A cost-benefit analysis is appropriate for those activities or services that are beyond what is considered "mission essential." For these, since there is no compelling reason to provide or perform the service, the appropriate analysis is the relatively more rigorous cost-benefit analysis. Here, the economic benefits of providing the service must be compared with the economic costs. If the benefits do not exceed the costs, the existence of the activity cannot be (economically) justified. In other words, economic costs and benefits alone may make an activity infeasible. Even if economic feasibility exists, other factors (such as "strategic fit" with mission-essential activities) must be considered before overall feasibility can be concluded.

Stock Maintenance performs a wide variety of operations, and there has been some disputation as to whether some or all of these operations should be performed by DLA. Part of our original tasking was to analyze each of the types of maintenance independently, but because segregated data was not available, we analyzed the overall economic feasibility. Because of this, we had to assume that the overall operations were not mission essential. This does not imply that this is our decision, merely that for the purposes of this study we must assume that the operations are not mission-essential.

2. Short Term versus Long Term Analysis

It is also necessary to decide if a short term or a long term perspective is appropriate. This decision will have an effect upon the use of the fixed costs. By definition, in the short run, fixed costs will be incurred regardless of management actions. In the long run, all costs vary with the

* See McGuigan and Moyer's Managerial Economics (St. Paul, MN: West Publishing Company, 1986), pp. 558-579 for a discussion of the differences between these two types of analysis and Chapter 17 for a more general discussion of public sector economic management.

size and scope of the operation and it is assumed that management can control all costs. Even if assets become idle, management can and will take the steps necessary to reallocate the resources: the assets (buildings, equipment, etc.), can be sold or used for other purposes and the personnel can be reassigned or laid off.

For the purposes of this study, where the possibility of changing the size or scope of the Stock Maintenance operations may be considered, it was determined that a long run perspective would be appropriate.

3. Selection of a Measure of Economic Feasibility

a. Income Contribution. In a short run analysis of Stock Maintenance economic feasibility, one measure alone is sufficient: are the total variable costs less than the total revenues? As long as total revenues exceed the variable costs (the excess is usually called an "income contribution" or "profit contribution"), and if Stock Maintenance management succeeds in minimizing the operating costs, it can be concluded that Stock Maintenance is doing well - in the short term. Even if total revenues are less than total costs, as long as they exceed variable costs, it will always be better to continue the operations from a short term economic perspective. If the operations are continued, the income contribution is used to offset some of the fixed costs. If the operations are stopped, then this offset is eliminated and the fixed costs are not reduced whatsoever.

b. Net Income

One measure that is useful in determining long range feasibility is a comparison of total revenues to total costs. This, along with the analysis of income contribution, can be used to determine the optimal workload. If the total revenues exceed the variable costs (a positive income contribution exists), but not the total costs (a negative net income exists) then, if the workload can be increased, the income contribution can be increased. If the workload can be increased enough, without having to increase the assets used, e.g., operating on two or three shifts instead of one, the income contribution may offset all fixed costs (a positive net income now exists). If there is a positive net income, it is then concluded that Stock Maintenance should continue in the long run. This assumes that the relationship between marginal revenues and marginal costs is linear over the workload range under consideration.

As already indicated, these first two measures describe short term performance and help set the workload such that Stock Maintenance is at least generating a positive net income.

While the net income measure discussed above incorporates costs associated with the depletion of assets through use (depreciation), none of the measures discussed incorporates any opportunity costs. These costs are the implied costs DLA incurs because of the choice made to have assets used by Stock Maintenance and thus unavailable for use elsewhere. For a manager responsible

for the best allocation of resources, a measure that does consider opportunity costs is appropriate. The measure selected should be useful as an indication of how well the resources are being used and should be consistent with other measures used by DLA to allocate resources.

c. Return on Assets Employed

One measure that can be used is the return on assets employed (ROAE). This method uses a long range perspective, accounts for opportunity costs and fits neatly with currently used discounted cash flow analyses of new capital projects.

With this measure, the net income the operations generate is considered conceptually equivalent to a return generated by an investment. The size of the investment is equal to the value of the assets used by the operations.

When the value of the assets is calculated, the fair market value of the assets must be used. The original purchase price of the assets must not be used. If it is, and the assets have declined in value, sunk costs are then included in the analysis.

In a discounted cash flow analysis, the discounted cash inflows and cash outflows are summed. If this sum, called the net present value, is positive, the project should be considered economical, feasible (i.e., profitable). With an analysis of the ROAE, if the return generated (as a percent of the asset value) is greater than the discount rate, the project can be considered to have met the criteria for economic feasibility. This assumes that the project is in a "steady state," and the period under consideration is representative of long range performance.

The use of this measure also obviates the need to determine the opportunity costs through an analysis of specific alternate uses of the Stock Maintenance assets. As long as DLA's assets and other capital resources continue to be evaluated and allocated through discounted cash flow analysis, performance of any activity that is not mission-essential can be evaluated using the return on assets employed.

Because ROAE includes all costs and considers the discount rate DLA uses in economic analyses, it was decided that the ROAE would be an appropriate measure of DLA Stock Maintenance economic feasibility.

C. Collection of Data and Assumptions

1. Collection of Data

A data request was sent to the depots in Ogden and Richmond. Data requested included total revenues, all of the variable and fixed costs and estimates of asset values and rental rates for warehouses.

Transportation costs were computed from data stored in the DLA Integrated Data Bank (DIDB). The Receipts file was searched for the return of any condition code F stock to either depot. Then, the number and weight of the shipments were calculated and transportation rate tables were used to calculate the likely cost to ship the materials back to the depots for repair.

2. Assumptions

Many assumptions were necessary. Some were made about the relationships between data available at one depot and not the other and about trends in the data from one time period to another; others were made about the relationships between reported costs and benefits and real costs and benefits. Where possible, the validity of these assumptions was checked with knowledgeable persons in Stock Maintenance, Supply Management or Depot Operations. Also, the assumptions were checked by comparing this data with the data generated by DDRV's Unit Price Model (UPM), for use during fiscal year 1988.

The most important assumptions are listed below:

- a. The aggregate operations were not mission essential. This assumption was discussed previously and requires that Stock Maintenance operations be evaluated with a cost-benefit analysis rather than a cost-effectiveness analysis.
- b. The relationship between marginal revenues and marginal costs will be linear over the workload range under consideration. This assumption was not necessary for overall evaluation of the Stock Maintenance operations, but would be necessary if a decision to expand operations were to be based upon the net economic benefits (total economic benefits less total economic costs).
- c. The Stock Maintenance operations were in a "steady state." For this study, it was assumed that the different activities within the Stock Maintenance operations were in equilibrium, i.e., the data for FY 87 was not distorted due to one portion of operations having a disproportionate effect on the historical data. For example, if items were added to F stock inventory at a much slower rate than the rate at which items were being repaired, the indicated costs for core materials would be lower than what was actually incurred. Violation of this assumption could result in a mismatching of costs and benefits. (In the private sector, this problem is partially offset through the reporting of sources and uses of funds.)
- d. The period studied was representative of long range performance. For example, it was necessary to assume that the types of items repaired and the supply of items repaired were typical of what will be available for the foreseeable future. If there are major changes, then the relationships demonstrated during FY 87 will not be the same as future relationships.

e. The value of repaired items could be represented by the unit price. This assumption probably overstated value in cases where new items could have been readily purchased for the unit price and it probably understated value where items were not commercially available. For items that were assembled or packaged, it may have fairly represented the value. As data was not available for determination of value on an item by item basis, the unit price was used for all items.

III. ANALYSIS. The results of the study are summarized in Table 1 for DDRV and Table 2 for DDOU. Detailed data, including specific information provided by the depots, assumptions regarding missing data and adjustments to compensate for mixed time periods, are in appendices A and B. These findings indicate a 27.6% ROAE for the Stock Maintenance operations at DDRV, which is equivalent to an investment of \$11 million yielding a 27.6% return, and a 10.6% ROAE at DDOU or an investment of \$14 million at 10.6%.

Table 1

ANALYSIS OF NET INCOME AND ROAE, DDRV

Stock Maintenance Division, FY 87
(thousands of dollars)

Estimated Total Revenues	12,928
Variable Costs	
Direct Materials	
Core Materials.....	6,784
Other Raw Materials.....	229
Total Materials.....	7,013
Direct Labor.....	1,124
Total Variable Costs.....	8,137
Income Contribution.....	4,791
Fixed Costs	
Indirect Labor.....	556
Overhead/Utilities.....	76
Depreciation.....	180
Admin. Costs.....	908
Total Fixed Costs.....	1,720
Net Income.....	3,071
Value of Assets Employed	
Inventory.....	9,438
Building and Equipment.....	1,673
Total Assets Employed.....	11,111
Return on Assets Employed.....	27.6%

Table 2

ANALYSIS OF NET INCOME AND ROAE. DDOU

Stock Maintenance Division, FY 87
(thousands of dollars)

Estimated Total Revenues	18,292
Variable Costs	
Direct Materials	
Core Materials.....	11,864
Other Raw Materials.....	228
Total Materials.....	12,092
Direct Labor.....	1,400
Total Variable Costs.....	13,492
Income Contribution.....	4,800
Fixed Costs	
Indirect Labor.....	759
Overhead/Utilities.....	2,060
Depreciation.....	320
Admin. Costs.....	141
Total Fixed Costs.....	3,280
Net Income.....	1,520
Value of Assets Employed	
Inventory.....	10,808
Building and Equipment.....	3,593
Total Assets Employed.....	14,401
Return on Assets Employed.....	10.6%

Table 3

COMPARISON OF ROAE WITH THE UNIT PRICE MODEL. DDRV

Stock Maintenance Division, FY 87

Comparisons of Mark-up	UPM	Adjusted ROAE Data
Fringe & Leave	32.9%	
Direct Overhead	48.6%	
Operational OH	13.9%	
General/Admin OH	43.9%	
Indirect Labor		49.5%
Utilities		6.7%
Admin. Costs		80.8%
Total Markup	139.3%	137.0%

A. Validity of Assumptions

To check the validity of the assumptions about some of the costs, the historical data provided by DDRV was compared to the data generated by DDRV's UPM for FY 87 (the UPM is an accounting and finance model used to help the Stock Maintenance operations determine the proper direct labor markups to cover the costs of overhead, benefits, etc.). This comparison was made by calculating a direct labor markup using the ROAE data. Although the individual cost categories used by the UPM and the ROAE are different, if the assumptions made in this study were correct, the total of the common costs and the total direct labor markups should be the same. The total markup calculated by the UPM was 139.3% of the direct labor costs, while the historical data used for the ROAE indicated a 137.0% markup (see Table 3). This agreement was due, at least in part, to both models using the same data base for their calculations - financial data maintained by the Comptroller's Office.

An attempt was made to verify data provided by DDRV with data maintained in JOTAMS for FY 87. JOTAMS has provisions for tracking the repair costs, the value of items returned to stock, etc.; however, the data for FY 87 was not reliable as the system was rarely used as designed and much of the data was not even entered into the system.

B. The Effect of Errors (Sensitivity Analysis)

There were two areas where accurate historical data was critical: total revenues and core costs. For revenues, small errors in the percent repaired and returned to inventory in issuable condition would have a dramatic effect on the analysis. One percent errors in estimates of total revenues result in four percent errors in net income and return on assets employed at DDRV and twelve percent errors at DDOU.

Also, as core costs and the costs of government furnished material comprise the major costs of doing business, errors here would also have a significant effect on the results (though not as significant as errors in the revenues). One percent errors in core costs would result in two percent errors in net income and return on assets employed at DDRV and eight percent errors at DDOU.

IV. CONCLUSIONS

- o The JOTAMS could have been the single source for the operating costs

While JOTAMS is a relatively simple computerized data base system, it is sophisticated enough to track almost all of the operating costs for the Stock Maintenance operations and it seemed logical to expect JOTAMS to be the source for the historical costs at each Depot. However, JOTAMS data for FY 87 is reported to have many errors. DDOU delegated the task of providing the information of this study to their Comptroller, and DDRV's costs were reported through the Defense General Supply Center's Office of Policy and Plans (DGSC-L). It is concluded from this observation, and verified through conversations with the developers of JOTAMS (DGSC-L), that the JOTAMS data is not reliable (at least for FY 87).

A source of the errors in the JOTAMS data base could have been the failure to regularly update the system and maintain the integrity of the data. While it is recognized that pressing daily problems have existed in the Stock Maintenance operations, the maintenance of accurate cost data on computerized information systems (in place) within the Stock Maintenance facilities must have a higher management priority in order to eliminate errors of this type.

o The current reporting of costs and savings is misleading

Current reporting of Stock Maintenance performance is misleading in that the operations tend to look more effective and efficient than they really are. This misrepresentation occurs through the present JOTAMS method of calculating and reporting Stock Maintenance "total savings."

The JOTAMS indicates "savings" as being the difference in the cost for Stock Maintenance to repair and the avoided cost for the Supply Center to purchase. While this is valid in principle, the current manner in which this difference is calculated and reported is misleading.

In this calculation, the costs used by JOTAMS do not include depreciation and core costs. The depletion of the value of the assets in use by the Stock Maintenance operations, and the costs of getting the items needing repair, are real costs to DLA. To properly evaluate the net economic benefits, these costs must be included. For example, JOTAMS data for the first quarter of FY88 indicate that the total savings created by DDRV's Stock Maintenance Division to be \$414,107 and the total costs incurred by DDRV to operate the Division was only \$78,077. One interpretation of this is that for every dollar spent by Stock Maintenance, over five dollars in net savings was realized. (This study would indicate that about 30 cents net is saved for every dollar spent.)

The current calculation for determining the avoided purchase costs uses the unit price and the number of items inducted into repair. These costs are then contrasted with the actual repair costs. However, the number of items scrapped in the repair process (an estimated 25%), has been ignored. This is an unsuitable comparison. (The economic measures of this study take account of this "breakage.")

o Stock Maintenance may be economically feasible.

The data collected indicates that the two divisions generate a net income of about \$5 million annually. It is estimated that the value of the assets in use by the two divisions is \$26 million. This yields an average ROAE of about 20%. However, it is felt that this data is not completely reliable and the net income may be overstated by as much as 100% or more.

Although the ROAEs calculated for the different Stock Maintenance activities appear to be quite different, with the estimates and assumptions necessitated by the lack of historical data, it is not clear that there is any real difference between the performance of the two divisions.

V. RECOMMENDATIONS

The primary recommendation is to modify the JOTAMS so that it generates more relevant economic information. Also, it is recommended that changes be made in the information flows from the Supply Center to the Depot. The implementation of these recommendations will provide for the development of an accurate historical cost data base and will allow for the determination of overall economic performance. With this data base, the Supply Centers and the Stock Maintenance Divisions will also be able to distinguish between costs incurred by each of the several classes of repair (new procurement repair, manufacture of items for clothing and textiles, repair of condition code F stock, routine maintenance and assembly type operations). Specifically it is recommended to:

- o Indicate all core costs. Because the core costs offset the net economic benefits generated by Stock Maintenance, it is felt that these costs, including the costs of Government Furnished Material, should be included in the JOTAMS reporting. There currently exists a seldom used field in the JOTAMS main data file that supposedly accounts for the cost of Government Furnished Materials. Either this field could be used for both or a field could be added for tracking the credit granted for reparable items.

- o Modify the system to allow tracking of costs by job type. The original scope of this project encompassed an analysis of each of the types of maintenance and repair. Modification of the JOTAMS to include an indicator of the type of repair would allow the analysis of the costs by type. In the main data file used by JOTAMS, a currently unused field exists that was originally intended to be used to indicate either mechanical or non-mechanical repairs. A possible solution would be to modify the data entry programs to allow the coding of repair type and the development of a report program to analyze costs by type.

- o Add the ability to calculate depreciation costs. Adding a file to JOTAMS containing a list of all depreciable property, with original purchase price, estimated market value, estimated useful life, etc., would allow the depreciation costs to be reported and controlled. Also, designating which jobs use which pieces of equipment would allow some changes in the way overhead is applied. In addition to the current method of direct labor hour markup, depreciation and some fixed costs could be applied to maintenance jobs based upon the machinery used, or by the space required, etc.

- o Add the ability to analyze changes in inventory. The determination of long run economic feasibility requires the assumption that current performance is indicative of long term performance. The ability to analyze periodic changes in net income is enhanced when changes in inventory are reported. In addition, there should be periodic reconciliations between the physical inventory and the amount used in the repair process as indicated on the JOTAMS reports.

- o Add to the information flow from the Supply Center to the Depot. The Supply Center should forward the core costs and the unit price of Government Furnished Material to the Stock Maintenance Divisions for their input into JOTAMS.

Appendix A

Detailed Data, DDRV

Stock Maintenance Division
Defense Depot Richmond, Virginia

Constructed Income Statement.

	1Q87	2Q87	3Q87	4Q87	FY 87
Total Revenues	3232	3232	3232	3232	12928
Variable Costs					
Direct Materials					
Reparable Item Cost	834	834	834	834	3336
Gov't Furn. Materials	862	862	862	862	3448
Total Core Costs	1696	1696	1696	1696	6784
Other Materials	56	67	53	53	229
Total Direct Materials	1752	1763	1749	1749	7013
Direct Labor	272	281	285	285	1124
Total Variable Costs	2025	2044	2034	2034	8137
Income Contribution	1207	1188	1198	1198	4791
Fixed Costs					
Indirect Labor	131	147	139	139	556
Utilities	19	19	19	19	76
Depreciation	45	45	45	45	180
Admin. Costs	227	227	227	227	908
Total Fixed Costs	422	438	430	430	1720
Net Income	785	750	768	768	3071

Return on Assets Employed.

Total Assets Employed FY 87	
Total Inventory.....	9438
Total Equipment.....	397
Building.....	1276
Total Assets Employed.....	11111
Net Income (yearly).....	3071
Return on Assets Employed.....	27.61

Stock Maintenance Division
Defense Depot Richmond, Virginia

Revenues Generated.

1. This was the value of the items returned to inventory in issuable condition.
2. The total price of the units inducted into repair at DDRV.
Total Value..... 17238
3. This figure was adjusted downward to account for those items that were shipped to DDRV but were not able to be repaired. The ratio was estimated for FY 87 based upon the actual ratio for 1Q FY 88.

Ratio of Reparables/Receipts. 75%

4. The value of the items returned to inventory.

Total Value..... 12928

5. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Total Revenues	3232	3232	3232	3232	3232	3232

Stock Maintenance Division
Defense Depot Richmond, Virginia

Core and Other Material Costs.

1. These were the costs for all of the parts and materials that went into the finished goods.
2. DDRV reported neither the Repairable Item Costs nor the Costs of Government Furnished Materials. These costs were developed as follows:
 - a. Core Costs are the costs to obtain the reparable items for repair and the value of GFM used in the assembly operations.
 - b. It was assumed that the acquisition costs were incurred in proportion to the labor costs in each department.
 - c. It was assumed that the core costs comprised 25% of the acquisition cost in the repair department and 80% of the acquisition cost in the assembly operations.

	Total	Repair	Assembly
% of Labor Force	100%	75%	25%
Acquisition Costs	17238	12928	4310
Core Material Costs as a % of the Acquisition Cost		25%	80%
Core Material Costs		3232	3448

3. The transportation costs to ship the reparable items to Richmond for the 1987 fiscal year.

Total Transportation..... 104

4. The assumed breakout of these figures into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Reparable Item Costs	808	808	808	808	808	808
Transportation	26	26	26	26	26	26
Total Rep. Item Cost	834	834	834	834	834	834
Gov't Furn. Material	862	862	862	862	862	862
Total Core Mater. Costs	1696	1696	1696	1696	1696	1696

5. Other Material Costs as reported by DDRV.

Other Materials	35	55	56	67	53	53
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Stock Maintenance Division
Defense Depot Richmond, Virginia

Costs of Direct and Indirect Labor.

1. These were the costs for labor and supervision used by the Stock Maintenance Division.
2. The labor costs were reported as indicated below.

	3Q86	4Q86	1Q87	2Q87

Costs of Direct Labor				
Regular Time	285	273	269	254
Overtime	32	12	6	41
Benefits	36	36	35	37
Total Labor	353	321	310	332

3. The reported costs for supervision for the 3&4 quarters of FY86 and the 1&2 Quarter of FY87.

Total Supervision..... 235

4. Per DLAM 7041.1, Economic Analysis, total benefit costs are generally 36% of the actual salary paid to a worker. As the current benefit costs were only about 14-15% of the total, it was assumed that the balance was deferred costs that were incurred at a rate equal to the current benefit costs.

5. The assumed breakout into total direct and indirect labor costs on a per quarter basis.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87

Costs of Direct Labor						
Regular Time	285	273	269	254	270	270
Overtime Base	21	8	4	27	15	15
Total Direct	306	281	273	281	285	285
Costs of Indirect Labor						
Supervision	59	59	59	59	59	59
Overtime Premium	11	4	2	14	8	8
Current Benefits	36	36	35	37	36	36
Deferred Benefits	36	36	35	37	36	36
Total Indirect Labor	142	135	131	147	139	139
Total Labor	448	416	404	428	424	424

Stock Maintenance Division
Defense Depot Richmond, Virginia

Utilities

1. These were the costs to operate the facilities used by Stock Maintenance
2. The figures reported by DDRV for the 1987 fiscal year.

Total Depot Utility Costs.....	1085
Percentage Allocated	
to Stock Maintenance.....	6.8%
Total Allocation.....	74

3. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Utility Costs	19	19	19	19	19	19

Stock Maintenance Division
Defense Depot Richmond, Virginia

Depreciation.

1. Although no depreciation costs were reported by either depot, it is reasonable to include depreciation as an operating cost.

Equipment

Hand Receipt Items.....	470	
Other Equipment.....	322	
Total Equipment.....	792	
Useful Life (years).....	10	
Yearly Depreciation.....		79

Estimated Original

Value of Warehouse.....	2551	
Useful Life (years).....	25	
Yearly Depreciation.....		102
Total Yearly Depreciation.....		181

2. The assumed breakout of the yearly depreciation into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Depreciation	45	45	45	45	45	45

Stock Maintenance Division
Defense Depot Richmond, Virginia

Clerical and Administrative Costs.

1. These were both the administrative costs incurred by the Stock Maintenance Division itself and the administrative costs incurred by the Depot in support of the Stock Maintenance Division.
2. The clerical and administrative costs reported were for FY 87.

Clerical Costs Generated	
within Stock Maintenance.....	122
Total Depot	
Administrative Costs.....	11509
Percentage Allocated	
to Stock Maintenance.....	6.8%
Total Allocation.....	784
Total Admin. and Clerical.....	906

3. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87

Admin. Costs	227	227	227	227	227	227

Stock Maintenance Division
Defense Depot Richmond, Virginia

Inventories.

1. The value of the Raw Material Inventory reported by DDRV.

Raw Materials.....	125
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2. The value of F stock in DDRV Inventory.

Based upon JOTAMS reporting for 1Q87, the estimated market value of this inventory may be as high as 80% of the unit price, but for this study, we have assumed a much lower 40%.

Total Reported Value.....	18200
Estimated Market Value.....	40%
Total Value.....	7280

3. Value of Gov't Furnished Materials.

DDRV did not report the value of the Government Furnished Materials. We assumed that the inventory level of GFM, as a percentage of its usage, was the same as the inventory level of Raw Materials, as a percentage of its usage.

Raw Material Inventory as a Percentage of Usage.....	236%
---	------

Gov't Furnished Material as a Percentage of Usage.....	236%
---	------

Value of Gov't Furnished Material Inventory.....	2033
--	------

Total Value of Inventories.....	9438
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Stock Maintenance Division
Defense Depot Richmond, Virginia

Value of Equipment.

1. This was the reported value less the estimated accumulated depreciation. We assumed the age of the equipment was half of its useful life.

Reported Value of Equipment.....	792	
Estimated Age (years).....	5	
Yearly Depreciation.....	79	
Accumulated Depreciation.....	395	
Estimated Current Value.....		397

Value of Warehouse.

1. The charge for warehouse space as per DoD Directive 4145.19, Storage and Warehousing Facilities, as updated, 6 November 1987.

Thousand square feet.....	140	
Rental Cost		
Dollars/sq.ft/year.....	2.01	
Total Yearly Rental Costs.....		281

2. The estimated original value of the warehouse was calculated by using the present value of a stream of cash outlays equal to the yearly rental cost.

Rental Costs.....	281	
Discount Rate.....	10%	
Lifetime (years).....	25	
Net Present Value.....		2551

3. The value of the warehouse for FY87 was the original value less accumulated depreciation. We assumed the age of the building was half of its useful life.

Estimated Age (years).....	12.5	
Yearly Depreciation.....	102	
Accumulated Depreciation.....	1275	
Estimated Current Value.....		1276

Stock Maintenance Division
Defense Depot Richmond, Virginia

Sensitivity Analysis

	Current	Case 1	Case 2
	<hr/>		
Total Revenues	12928	12799	12928
% change		-1%	0%
Total Core Materials	6784	6784	6852
% change		0%	1%
Other Variable Costs	1353	1353	1353
Total Variable Cost	8137	8137	8205
Income Contribution	4791	4662	4723
Total Fixed Costs	1720	1720	1720
Net Income	3071	2942	3003
% difference		-4%	-2%
ROAE	27.6%	26.5%	27.0%
% difference		-4%	-2%

Appendix B

Detailed Data DDOU

Stock Maintenance Division
Defense Depot Ogden, Utah

Constructed Income Statement.

	1Q87	2Q87	3Q87	4Q87	FY 87
Total Revenues	4573	4573	4573	4573	18292
Variable Costs					
Direct Materials					
Reparable Item Cost	966	966	966	966	3864
Gov't. Furn. Material	2000	2000	2000	2000	8000
Total Core Materials	2966	2966	2966	2966	11864
Other Raw Materials	43	57	64	64	228
Total Materials	3009	3023	3030	3030	12092
Direct Labor	336	360	352	352	1400
Total Variable Costs	3345	3383	3382	3382	13492
Income Contribution	1228	1190	1191	1191	4800
Fixed Costs					
Indirect Labor	185	192	191	191	759
Overhead	515	515	515	515	2060
Depreciation	80	80	80	80	320
Admin. Costs	34	37	35	35	141
Total Fixed Costs	814	824	821	821	3280
Net Income	414	366	370	370	1520

Return on Assets Employed.

Total Assets Employed FY 87	
Total Inventory.....	10808
Total Equipment.....	268
Building.....	3325
Total Assets Employed.....	14401
Net Income (yearly).....	1520
Return on Assets Employed... ..	10.6%

Stock Maintenance Division
Defense Depot Ogden, Utah

Revenues Generated.

1. This was the value of the items returned to inventory in issuable condition.

2. The total price of the units inducted into repair at DDOU.

Total Value..... 24390

3. This figure was adjusted downward to account for those items that were shipped to DDOU but were not able to be repaired. The ratio was estimated for FY 87 based upon the actual ratio for 1Q FY 88 at DDRV.

Ratio of Reparables/Receipts..... 75%

4. The value of the items returned to inventory.

Total Value..... 18292

5. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Total Revenues	4573	4573	4573	4573	4573	4573

Stock Maintenance Division
Defense Depot Ogden, Utah

Costs of Materials.

1. These were the costs for all of the parts and materials that went into the finished goods.
2. DDOU reported neither the Repairable Item Costs nor the Costs of Government Furnished Material. These costs were estimated as follows:
 - a. Core Costs are the costs to obtain the reparable items for repair and the value of GFM used in the assembly operations.
 - b. It was assumed that the acquisition costs were incurred in proportion to the labor costs in each department.
 - c. It was assumed that the core costs comprized 25% of the acquisition cost in the repair department and 80% of the acquisition cost in the assembly operations.

Costs of Core Materials.	Total	Repair	Assembly
% of Labor Force	100%	59%	41%
Revenue Allocated to Each	24390	14390	10000
Core Material Costs as a % of the Reported Revenue		25%	80%
Core Material Costs		3598	8000

3. The transportation costs to ship the reparable items to Ogden for FY 87.

Total Transportation..... 262

4. The assumed breakout of these figures into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Core Material Costs						
Reparable Item Costs	900	900	900	900	900	900
Transportation	66	66	66	66	66	66
Total Rep. Item Costs	966	966	966	966	966	966
Gov't Furn. Material	2000	2000	2000	2000	2000	2000
Total Core Mater. Costs	2966	2966	2966	2966	2966	2966

5. Other Raw Material Costs reported by DDOU.

Other Raw Material Costs	99	56	43	57	64	64
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Stock Maintenance Division
Defense Depot Ogden, Utah

Costs of Direct Labor and Supervision.

1. These were the costs for the labor and supervision used by the Stock Maintenance Division.

2. The labor costs were reported as indicated below.

	3Q86	4Q86	1Q87	2Q87
	-----	-----	-----	-----
Total Labor	400	436	395	423

3. The reported costs for supervision for the 3&4 quarters of FY 86 and the 1&2 quarters of FY 87.

	3Q86	4Q86	1Q87	2Q87
	-----	-----	-----	-----
Total Supervision	56	60	58	57

4. It was assumed that the current cost of benefits was about 15% of the salary of a worker and that it was included in the reported labor costs. Furthermore, it was assumed that deferred benefit costs were incurred at a rate equal to the current benefit costs.

5. The assumed breakout into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
	-----	-----	-----	-----	-----	-----
Costs of Direct Labor	340	371	336	360	352	352
Costs of Indirect Labor						
Supervision	48	51	49	48	49	49
Current Benefits	68	74	68	72	71	71
Deferred Benefits	68	74	68	72	71	71
Total Indirect Labor	184	199	185	192	191	191

Stock Maintenance Division
Defense Depot Ogden, Utah

Factory Overhead.

1. These were the costs to operate the facilities used by Stock Maintenance.
2. DDOU included some administrative support in these figures.
3. The figures reported by DDOU for FY 87.

Total DDOU P900 Costs.....	17034
Percentage Allocated	
to Stock Maintenance.....	12.7%
Total Allocation	2061

4. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Factory Overhead	515	515	515	515	515	515

Stock Maintenance Division
Defense Depot Ogden, Utah

Depreciation.

1. Although no depreciation costs were reported by either depot, it is reasonable to include depreciation as an operating cost.

Value of Equipment.....	538	
Useful Life (years).....	10	
Yearly Depreciation.....		54

2. Estimated Original

Value of Warehouse.....	6663	
Useful Life (years).....	25	
Yearly Depreciation.....		267

Total Yearly Depreciation.....		321
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3. The assumed breakou of these figures into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Depreciation	80	80	80	80	80	80

Stock Maintenance Division
Defense Depot Ogden, Utah

Clerical and Administrative Costs.

1. These were the costs incurred by the Stock Maintenance Division.
2. The clerical and administrative costs reported are below.

	3Q86	4Q86	1Q87	2Q87
Admin. & Clerical Costs	33	34	34	37

3. The assumed breakout of this figure into per-quarter figures.

	3Q86	4Q86	1Q87	2Q87	3Q87	4Q87
Admin. & Clerical Costs	33	34	34	37	35	35

Stock Maintenance Division
Defense Depot Ogden, Utah

Inventories.

1. The value of the Raw Material Inventory at DDOU.

Raw Materials (2 X quarterly usage)..... 128

2. The value of F stock in DDOU Inventory.

Here, as with DDRV, we assumed the Market Value was only 40% of the unit price of the inventory, although some data exists which would indicate that it may be as high as 80%.

Total Reported Value..... 16700
Estimated Market Value..... 40%
Total Value..... 6680

3. Value of Gov't Supplied Materials.

DDOU did not report the value of Government Furnish Material inventory. We assumed that the value of the GFM inventory, as a percent of usage, was the same as the value of the Raw Materials inventory as a percentage of its usage.

Raw Material Inventory
as a Percentage of Quarterly Usage..... 200%

Gov't Furnished Material
as a Percentage of Quarterly Usage..... 200%

Value of Gov't Furnished Material Inventory..... 4000

Total Value of Inventories..... 10808

Stock Maintenance Division
Defense Depot Ogden, Utah

Value of Equipment.

1. This was the reported value less accumulated depreciation, assuming the age of the equipment was half of its useful life

Reported Value.....	538	
Estimated Age (years).....	5	
Yearly Depreciation.....	54	
Accumulated Depreciation.....	270	
Estimated Current Value.....		268

Value of Warehouse.

1. The charge for warehouse space as per DoD Directive 4145.19, Storage and Warehousing Facilities, as updated, 6 November 1987.

Thousand square feet.....	365	
Rental Cost		
Dollars/sq.ft/year.....	2.01	
Total Yearly Rental Costs.....		734

2. The original value of the warehouse was calculated by using the present value of a stream of cash outlays equal to the yearly rental cost.

Rental Costs.....	734	
Discount Rate.....	10%	
Lifetime (years).....	25	
Net Present Value.....		6663

3. The value of the warehouse in FY 87 was the original value less accumulated depreciation. We assumed the age was half of the useful life.

Estimated Age (years).....	12.5	
Yearly Depreciation.....	267	
Accumulated Depreciation.....	3338	
Estimated Current Value.....		3325

Stock Maintenance Division
Defense Depot Ogden, Utah

Sensitivity Analysis

	Current	Case 1	Case 2
Total Revenues	18292	18109	18292
% change		-1%	0%
Total Core Materials	11864	11864	11983
% change		0%	1%
Other Variable Costs	1628	1628	1628
Total Variable Costs	13492	13492	13611
Income Contribution	4800	4617	4681
Total Fixed Costs	3280	3280	3280
Net Income	1520	1337	1401
% difference		-12%	-8%
ROAE	10.6%	9.3%	9.7%
% difference		-12%	-8%

except as noted, all figures in thousands

Appendix C

List of Abbreviations

<u>Abbreviation</u>	<u>Meaning</u>
DDOU	Defense Depot Ogden, Utah
DDRV	Defense Depot Richmond, Virginia
DIDB	DLA Integrated Data Bank
DLA	Defense Logistics Agency
DLA-LO	Defense Logistics Agency, Operations Research and Economic Analysis Office
DGSC-L	Defense General Supply Center, Office of Policy and Plans
F	Supply Condition Code for Unserviceable but Recoverable Material
FY	Fiscal Year
GFM	Government Furnished Material
JOTAMS	Job Order Tracking and Management System
OH	Overhead
ROAE	Return on Assets Employed
UPM	Unit Price Model

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<p>The purpose of this study was to determine the economic feasibility (profitability) of DLA's materiel maintenance mission. Specifically, this study examined the economic feasibility of stock maintenance operations. The study results showed DLA's maintenance operations to be generally economically sound. The yearly net economic value generated, compared with the value of the assets employed, represented a rate of return greater than 10 percent. It was estimated that the total economic benefits generated during Fiscal Year 1987 were \$32 million, the total economic costs were \$26 million and the value of the assets employed was \$26 million. Because of the questionable validity of some of the data used for this analysis, it was recommended that, before any decision is made which would make major changes to the size or scope of the operations, an additional analysis should be made using more reliable historical data. The primary recommendation of the study was to modify the Job Order Tracking and Management System used by the stock maintenance operations to allow the generation of this valid historical cost data base.</p>					
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